

2017 Cooling Tower Assessment for Regulation 85

Facility:	Cherokee Station (CDPS Permit #CO-00001104)
Source Water:	<p>COSPUS15 / High Priority Watershed – South Platte River (u/s 58th Ave)</p> <p>COSPUS15 / High Priority Watershed – South Platte River (d/s Metro WW Hite facility discharge)</p> <p>COSPCL15 / High Priority Watershed – Fisher Ditch Diversion to Copeland Reservoir</p> <p>NA / NA – Denver Water Recycled Water Plant</p>
Receiving Water:	COSPUS15 / High Priority Watershed – South Platte River
USGS 8-digit HUC:	10190002 (South Platte) and 10190004 (Clear Creek)
Design flow:	≥ 2.0 MGD (3.1 MGD permitted monthly average; actual monthly average during the sampling period was 1.1 MGD)
Owner/Operator:	Public Service Company of Colorado (PSCo)
Facility Description:	<p>PSCo's Cherokee Station is an electric power generating facility (928 MW) operating in the Denver Metro area. Water for cooling is withdrawn from a number of sources, including two locations on the South Platte River, Clear Creek (through Copeland Reservoir) and reclaimed water delivered to Cherokee Station from the Denver Water Reclaim Facility. An estimated 90% of intake water is used for cooling purposes. Chemicals are added to cooling tower water to prevent corrosion, scale, and bio-fouling. An estimated 75% of the discharge is cooling tower blowdown, which is a slip stream that removes accumulated solids remaining from the evaporation of water. The water intake into the cooling water system and blowdown from the cooling tower are not measured, so the contributions are estimates. Cooling tower blowdown, along with other low-volume wastes and bottom ash water flow to an on-site lift station where the wastewater is treated through a clarifier with the addition of lime and ferric chloride. The treated water then flows through two settling ponds for further settling and pH control before discharge to the South Platte River. Alternatively, treated wastewater from the final settling pond can be pumped back into the plant water systems for reuse.</p>
Cooling towers:	<p>Cooling towers at this facility operate to maximize evaporation of heat collected during the non-contact cooling process. During the evaporation of water vapor, the remaining solids from intake water and any chemical additives are concentrated and ultimately removed from the cooling tower in the blowdown stream. The concentrating and blowdown rates are dependent on temperature, calcium hardness and other facility-specific factors.</p>

Chemical loading: Chemical additives are minimized by this facility based on economics, intake water quality, and other impacts from usage. During the monitoring period, no chemicals containing phosphorus, nitrate, nitrite, or ammonia were utilized in the cooling water system.

Estimated nutrient load factors (based on the average of collected data from 2012-2014):

Average Load Factors	Intake Water*	Outfall 001**	
Total Inorganic Nitrogen	283 lbs/day	200 lbs/day	2394 lbs/yr
Total Nitrogen	321 lbs/day	212 lbs/day	2550 lbs/yr
Total Phosphorus	10 lbs/day	0.18 lbs/day	66 lbs/yr

**Intake water load factors were averaged from all data collected over the monitoring period. Data collected at the Northwest Reservoir representing the "mixed" water sources in the pond were used to calculate the intake load.*

***There is no access for sample collection or flow monitoring of the cooling tower blowdown only. Outfall 001A is the primary discharge point of all treated wastewater to the South Platte River. For the purposes of this analysis, it is assumed that all of the load at the outfall comes from the cooling tower blowdown.*

The above load factors represent a snapshot of conditions at the facility. Water collected at the facility's intake is transported to a settling pond (Northwest Reservoir) for use in the cooling towers and other systems. The cooling tower water is recirculated many times prior to blowdown to maximize efficient water use. Therefore, the mass balance equation of intake + chemical addition = blowdown is too simplistic due to lag times, varying operations and source water conditions (hardness, etc) that may require more or less blowdown, and settling that occurs in the cooling tower basins. In addition, treated wastewater can be diverted from discharge and reused in the plant processes. However, the information can provide evidence of some general conclusions:

- 1) Load factors showed decreases between intake water and the outfall.
- 2) Chemical additions did not occur during the monitoring period.
- 3) In comparison to domestic wastewater treatment plants, Cherokee Station does not add any measureable nutrient load.

Operation type: Continuous

Data: No additional data

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Facility:	Comanche Station (CDPS Permit #CO-0000612)
Source Water:	COARMA02 / High Priority Watershed – Arkansas River
Receiving Water:	COARMA06B / High Priority Watershed – St. Charles River
USGS 8-digit HUC:	11020002
Design flow:	≥ 2.0 MGD (5.17 MGD permitted monthly average; actual monthly average during the sampling period was 1.9 MGD)
Owner/Operator:	Public Service Company of Colorado (PSCo)
Facility Description:	<p>PSCo's Comanche Station is an electric power generating facility (1410 MW) operating in the Pueblo area. Water for cooling is withdrawn from the Arkansas River just downstream of Pueblo Reservoir. Raw water flows into a settling pond before use in the plant. Approximately 70% of intake water is used for cooling purposes. Chemicals are added to cooling tower water as needed to prevent corrosion, scale and bio-fouling. More than half of the discharge at outfall 001 is cooling tower blowdown, which is a slip stream that removes accumulated solids remaining from the evaporation of water. The water intake into the cooling water system and blowdown from the cooling tower are not measured, so the contributions are estimates. Cooling tower blowdown, stormwater, low volume wastewaters, and treated sanitary wastewater flow to the primary plant lift station to two settling ponds (in-series) for solids settling and pH control prior to discharge through outfall 001 to the St. Charles River. Alternatively, treated wastewater from the final settling pond can be pumped back into the plant processes for reuse and is not discharged through the outfall.</p>
Cooling towers:	<p>Cooling towers at this facility operate to maximize evaporation of heat collected during the non-contact cooling process. During the evaporation of water vapor, the remaining solids from intake water and any chemical additives are concentrated and ultimately removed from the cooling tower in the blowdown stream. The concentrating and blowdown rates are dependent on temperature, calcium hardness and other facility-specific factors. Much of the blowdown from Unit 3 is reused in the plant's air pollution control equipment and does not reach the primary plant lift station. Unit 3 employs hybrid-cooling ; both wet and dry cooling. Thus, direct contribution from cooling tower blowdown from Unit 3 to the wastewater process is minimal.</p>
Chemical loading:	<p>Chemical additives are minimized by this facility based on economics and other impacts from usage. This facility applies chemicals on a part per million (ppm) basis year-round in the cooling towers when generating power. Chemical feed does not necessarily occur</p>

daily. Comanche tracks its chemical usage on a quarterly and annual basis. Average chemical use for the three chemicals utilized in the cooling system that contain phosphorus during the monitoring period was approximately 7000 gallons. While some increase in phosphorus is noted between the intake and the blowdown, the increase is negligible.

Further, the blowdown loading is more appropriate than chemical loading as it integrates the intake water, cooling tower operations and chemical additions. While actual calculation of added chemical loading is impossible, a qualitative comparison is possible as described below.

Estimated nutrient load factors (based on the average of collected data from 2012-2014):

Average Load Factors	Intake Water*	Cooling Tower Blowdown**	
Total Inorganic Nitrogen	13 lbs/day	11 lbs/day	4271 lbs/yr
Total Nitrogen	33 lbs/day	21 lbs/day	7671 lbs/yr
Total Phosphorus	1 lbs/day	6 lbs/day	2277 lbs/yr

**Intake water load factors were averaged from all data collected over the monitoring period. Raw water at Comanche is treated through two clarifiers. Flow data utilized in the calculation represent the amount of treated water through both clarifiers (post-treatment). A monthly average flow was used. The water is not metered before it goes into the clarifier, but is the location of the water quality samples. From the clarifiers, the water is distributed throughout the Comanche plant, including the cooling water system.*

***There is no access for sample collection or flow monitoring of the cooling tower blowdown only. Outfall 001 is the primary discharge point of all treated wastewater to the St. Charles River. For the purposes of this analysis, it is assumed that all load at the outfall comes from the cooling tower blowdown.*

The above load factors represent a snapshot of conditions at the facility. Water collected at the facility's intake is transported to the raw water pond. The cooling tower water is recirculated many times prior to blowdown to maximize efficient water use. Therefore, the mass balance equation of intake + chemical addition = blowdown is too simplistic due to lag times, reuse, varying operations and source water conditions (hardness, etc) that may require more or less blowdown, and settling that occurs in the cooling tower basins. However, the information can provide evidence of some general conclusions:

- 1) Load factors showed small decreases between intake water and cooling tower blowdown for total inorganic nitrogen and total nitrogen.
- 2) Chemical additions did not significantly increase the phosphorus load in the cooling towers.
- 3) In comparison to domestic wastewater treatment plants, Comanche Station does not contribute a significant nutrient load.

Operation type: Continuous

Data: No additional data.

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Facility:	EVRAZ Rocky Mountain Steel (CDPS Permit #CO-0000621)
Source Water:	Arkansas River
Receiving Water:	Arkansas River, COARLA01a
USGS 8-digit HUC:	11020002
Design flow:	57 MGD permit limit, average approx. 38 MGD (cooling tower portion of discharge averages ~0.25 MGD)
Owner/Operator:	EVRAZ North American
Facility Description:	EVRAZ Rocky Mountain Steel is a steel mini-mill located on the southeast side of Pueblo CO. EVRAZ takes scrap steel and recycles it in the steelmaking facility where it is melted, and casted into round blooms. The blooms are then taken to either the rod, rail, or seamless tube mill where they are reheated and rolled into the final products. Four operating cooling towers support the steelmaking facility. Less than 10% of intake water is used for cooling tower purposes. Chemicals are added to cooling tower water to prevent corrosion, scale and bio-fouling. Cooling tower makeup and blowdown is difficult to track as the cooling towers either do not have meters, overtop their basins, gain condensate water, evaporate, leak, or the conductivity does not get high enough to blowdown. All of the cooling towers are directly piped into the facility's industrial wastewater piping system and combined into one outfall with other cooling water used throughout the mill.
Cooling towers:	Cooling towers at this facility operate to maximize evaporation of heat collected during the non-contact cooling process. During the evaporation of water vapor, the remaining solids from intake water and any chemical additives are concentrated and ultimately removed from the cooling tower in the blowdown stream. The concentrating and blowdown rates are dependent on temperature, calcium hardness and other facility-specific factors.

Estimated nutrient load factors (based on the average of collected data from 2012-2014):

Nutrient concentrations measured in the raw water intake, total plant effluent, and the four cooling towers are summarized in Table 1. Estimated flows are also provided in Table 1. The cooling tower flows are best estimates and not precise measurements. Table 2 provides estimated loads for the same locations. As shown in Table 2, the cooling tower discharges make up a very small percentage of nutrient loading from the facility, on the order of 1-2% for nitrogen and 5-7% for phosphorus. The total plant effluent also includes flows from a small sanitary sewer plant (<1.0 MGD).

Table 1. Median Nutrient Concentrations

Median Concentrations (mg/L) and Average Flow Rate (MGD)						
	Raw Intake and Total Effluent		Cooling Tower Discharges			
Nutrient	Res. Water Intake	Total Plant Effluent (PE)	BO	DE	EA	VT
TN (mg/L)	0.77	0.72	1.04	2.45	1.39	2.40
TIN (mg/L)	0.21	0.35	0.21	1.08	0.22	0.55
TP (mg/L)	0.05	0.05	0.37	0.60	0.42	0.05
Avg. Est. Flow Rate (MGD)	31.19	38.62	0.073	0.019	0.073	0.078

Table 2. Estimated Nutrient Loads

Estimated Loads (lbs/day)								
	Raw Intake and Total Effluent		Cooling Tower Discharges					
Nutrient	Res. Water Intake	Total Plant Effluent (PE)	BO	DE	EA	VT	Estimated Cumulative Cooling Tower Load	Relative Cooling Tower % of Plant Effluent Load
TN (lbs/day)	214	265	0.80	0.45	1.01	2.03	4.29	2%
TIN (lbs/day)	51	111	0.13	0.21	0.15	0.84	1.33	1%
TP (lbs/day)	14	13	0.31	0.12	0.41	0.03	0.86	7% (5% if median TP used)

RES = Reservoir, Mill water inlet, point 300I in permit. Flow meter in pipe to chart recorder. The mill water coming to the plant is fed from a 60" concrete pipe from the St. Charles reservoirs which get their water mostly from the Arkansas River and also the St. Charles River. No initial treatment other than a rotating screen. This is the inlet water to the plant as well as the 4 cooling towers.

PE = Plant Effluent, Final lagoon and discharge point 001A in permit. 10' Parshall Flume with staff gauge and real time float recorder. The water from the cooling towers is directly piped into our industrial sewer system where it then goes through a series of settling ponds and through our final outfall prior to entering the Arkansas River. Treatment is solids settling and oil skimming. No chemicals are added for treatment.

BO = BOFCT = Basic Oxygen Furnace Cooling Tower, serves the Ladle Metallurgy Station (LMS) system and EAF water cooled duct. LMS takes the molten steel from the EAF and further adjust the chemistry and temperature of the steel.

DE = DEMAGCT = Demag. Caster Cooling Tower, serves the continuous casting system. Caster takes the molten steel from the VTD and casts the steel into solid bars which will go to one of the rolling mills. Has a scale pit, filters, clarifier, & holding tank.

VT = VTDCT = Vacuum Tank Degasser Cooling Tower, serves the VTD system. VTD takes the molten steel from the LMS puts a vacuum on a ladle of molten steel and removes any pockets of trapped gases within the steel. To help the process Argon gas is bubbled through the steel and then any gases and particulates coming off the steel are eventually caught in the VTD water system. Has softened city water going to a boiler, seal tank, vacuum chamber, clarifier, thickener, filter press, ejectors, and condensers.

Not shown in table: SPOUT = Domestic Sewage Plant Outfall, point 002A in permit. Weir with staff gauge and chart recorder. Sewage plant is <1 MGD and has two aeration lagoons then a clarifier.

Operation type: Daily if market conditions exist.

Operations in 2016: Production was cut in about half due to poor market conditions.

Other facility info:

Data: *From 2-26-15 submittal*

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Facility:	Front Range Energy LLC (CDPS Permit #CO-0047635)
Source Water:	Well Water / Process Water
Receiving Water:	COSPCP12, the Cache La Poudre River
USGS 8-digit HUC:	10190007 – Cache La Poudre
Design flow:	< 1.0 MGD (0.482 MGD permitted 30-day average)
Owner/Operator:	Front Range Energy LLC
Facility Description:	<p>Front Range Energy LLC is an ethanol production facility. The facility's cooling tower is continuously operated to ensure that temperature control is maintained in the ethanol production process and that scale, corrosion, fouling and microbiological contamination are also controlled. The primary source of inflow to the cooling tower is process water which originates from well water that is filtered by a nano-filtration system. The permeate flow (process water) makes up the cooling tower water. The discharge of the cooling tower (cooling tower blowdown) is one of four streams that comprise FRE's total effluent. FRE is currently permitted to discharge 0.482 MGD. The cooling tower discharge makes up approximately 22% of FRE's total effluent.</p>
Cooling towers:	<p>FRE operates an "open" recirculating system for cooling the water used in the ethanol production facility, where heat is expelled through the process of evaporation. The evaporative cooling lowers the temperature of the water, which circulates through various types of heat exchange equipment, picks up heat, and returns to the "open" tower to repeat the cycle. FRE uses cooling tower water treatment products from US Water Services. FRE utilizes the recommended treatment products so that costly problems with the cooling loop do not interrupt the ethanol production operation. The primary source of FRE's inflow to the cooling tower is process water which originates from well water that is filtered by a nano-filtration system. The permeate flow (process water) makes up the cooling tower water.</p>
Nutrient loads:	<p>Estimated nutrient loads are based on the average of collected data from 2012-2014:</p>

Table 1: Values reflect actual analytical results

Nutrient	Intake Water/Background Loads*	Cooling Tower Blowdown Loads**	
Total Inorganic Nitrogen	18.94 lbs/day	19.60 lbs/day	7,155.45 lbs/yr
Total Nitrogen	19.36 lbs/day	20.17 lbs/day	7,361 lbs/yr
Total Phosphorus	0.03 lbs/day	1.56 lbs/day	567.89 lbs/yr

**Intake water loads were averaged from all data collected over the monitoring period.*

***Cooling tower blowdown loads were averaged from all data collected over the monitoring period. Discharge flows are relatively constant when in operation. Therefore, annual loads were based on the average daily load multiplied by the historical maximum of 12 months of operation.*

Table 2: Values reflect actual analytical results for intake water; the loading in the cooling tower is analytical results minus background concentrations

Nutrient	Intake Water/Background Loads*	Cooling Tower Blowdown Loads**	
Total Inorganic Nitrogen	18.94 lbs/day	0.66 lbs/day	241.24 lbs/yr
Total Nitrogen	19.36 lbs/day	0.80 lbs/day	293.74 lbs/yr
Total Phosphorus	0.03 lbs/day	1.52 lbs/day	553.52 lbs/yr

**Intake water loads were averaged from all data collected over the monitoring period.*

***Cooling tower blowdown loads were averaged from all data collected over the monitoring period. Discharge flows are relatively constant when in operation. Therefore, annual loads were based on the average daily load minus the background load, multiplied by the historical maximum of 12 months of operation.*

The above load estimates represent a snapshot of conditions at the facility. Cooling tower water is recirculated many times prior to blowdown to maximize efficient water use. Therefore, the mass balance equation of intake + chemical addition = blowdown is too simplistic due to lag times, varying operations and source water conditions (hardness, etc.) that may require more or less blowdown, and settling that occurs in the cooling tower basins. However, the information provides supporting evidence for several general conclusions:

- 1) For nitrogen, there were negligible (<5%) increases between intake water and cooling tower blowdown. Chemicals did not significantly increase nitrogen loading relative to the intake water.

- 2) For phosphorus, the daily loading is low relative to domestic wastewater treatment plants.
- 3) Despite relatively low loading for both N and P, FRE would not meet technology based effluent limits for TIN and TP established in Regulation 85 for existing facilities.

Operation type: Daily (During 2012-2014)

Operations 2015/2016: Daily

Data: Based on data submitted to CDPHE in accordance with Regulation 85 monitoring requirements.

2017 Cooling Tower Assessment for Regulation 85

Facility:	Fort St. Vrain Station (CDPS Permit #CO-0001121)
Source Water:	COSPMS01A / High Priority Watershed – South Platte River COSPSV03 / High Priority Watershed – St. Vrain Creek
Receiving Water:	COSPMS01A / High Priority Watershed – South Platte River (outfall 001B) COSPSV03 / High Priority Watershed – St. Vrain Creek (outfall 002A)
USGS 8-digit HUC:	10190003 and 10190005 (Middle South Platte and St. Vrain Creek)
Design flow:	≥ 2.0 MGD (2.4 MGD permitted monthly average; actual monthly average during the sampling period was 1.4 MGD)
Owner/Operator:	Public Service Company of Colorado (PSCo)
Facility Description:	<p>PSCo's Fort St. Vrain Station is an electric power generating facility (969 MW) operating near Platteville. Water for cooling is withdrawn from both the South Platte River and St. Vrain Creek. Raw water flows into two settling ponds and then recombines for distribution to the cooling water system and for other purposes in the plant. Approximately 94% of intake water is used for cooling purposes. Chemicals are added to cooling tower water, as needed, to prevent corrosion, scale, and bio-fouling. Approximately half of the discharge through outfall 002A is cooling tower blowdown, which is a slip stream that removes accumulated solids remaining from the evaporation of water. Cooling tower blowdown flows to the Cooling Water Detention Pond. Discharge from the pond comingles with other low-volume wastes, including treated sanitary wastewater, and flows through either outfall 001B (to the South Platte River) or 002A (to the St. Vrain Creek).</p>
Cooling towers:	Cooling towers at this facility operate to maximize evaporation of heat collected during the non-contact cooling process. During the evaporation of water vapor, the remaining solids from intake water and any chemical additives are concentrated and ultimately removed from the cooling tower in the blowdown stream. The concentrating and blowdown rates are dependent on temperature, calcium hardness and other facility-specific factors.
Chemical loading:	Chemical additives are minimized by this facility based on economics, intake water quality, and other impacts from usage. This facility applies chemicals on a part per million (ppm) basis year-round in the cooling towers when generating power. There are two chemicals used in the cooling water system that contain phosphorus. Chemical feed does not necessarily occur daily. The amount of chemicals added to the cooling

water system was not considered in the load calculation below because the discharge load is lower than the incoming load. Thus, the actual impact from chemical additions is not a factor when comparing the incoming load to the outgoing load.

Estimated nutrient load factors (based on the average of collected data from 2012-2014):

Average Load Factors	Intake Water*	Cooling Tower Blowdown**	
Total Inorganic Nitrogen	169 lbs/day	98 lbs/day	35936 lbs/yr
Total Nitrogen	225 lbs/day	110 lbs/day	40210 lbs/yr
Total Phosphorus	20 lbs/day	12.0 lbs/day	4291 lbs/yr

**Intake water load factors were averaged from all data collected over the monitoring period. The raw water pump discharge flow is not measured and is estimated based on the amount of water that flows from the two ponds and used for cooling,*

***Cooling tower blowdown flows into the Cooling Water Detention Pond. Flow is not measured and is estimated based on the flow totalizer on the pump that pumps blowdown from the cooling tower to the pond.*

The above load factors represent a snapshot of conditions at the facility. Water collected at the facility's intake is transported to two settling ponds for use in the cooling towers or other systems. The cooling tower water is recirculated many times prior to blowdown to maximize efficient water use. Therefore, the mass balance equation of intake + chemical addition = blowdown is too simplistic due to lag times, varying operations and source water conditions (hardness, etc) that may require more or less blowdown, and settling that occurs in the cooling tower basins. However, the information can provide evidence of some general conclusions:

- 1) Load factors showed decreases between intake water and cooling tower blowdown.
- 2) Chemical additions are not a factor in the loads calculated from the cooling towers.
- 3) In comparison to domestic wastewater treatment plants, Fort St. Vrain Station does not add any measurable nutrient load.

Operation type: Continuous

Data: While the permit does authorize discharge of treated wastewater through either outfall 001B or 002A, FSV primarily discharges through outfall 002A.

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Facility: MillerCoors, LLC (CDPS Permit #COG605013)

Source Water: COSPCL11 / High Priority Watershed – Clear Creek

Receiving Water: COSPCL11 and 14a / High Priority Watershed – Clear Creek

USGS 8-digit HUC: 10190004

Design flow: ≥ 2.0 MGD (combined flow = 63.7 mgd)

Owner/Operator: MillerCoors, LLC

Facility Description: MillerCoors operates once-through cooling towers. The cooling tower source water is from Clear Creek diverted at an inlet located adjacent to the Agricultural Ditch. Effluent is discharged at four outfalls to Clear Creek (labeled outfalls 006, 007, 008, and 011).

Chemical loading: This facility does not use chemical additives containing phosphorus or nitrogen.

Median nutrient concentrations (based on collected data from 2013-2015):

Median concentrations	Intake Water	Cooling Tower Effluent			
		006	007	008	011
Total Inorganic Nitrogen	0.23 mg/L	0.23	0.29	0.26	0.26
Total Nitrogen	0.43 mg/L	0.49	0.45	0.53	0.51
Total Phosphorus	0.01 mg/L	0.02	0.01	0.02	0.01

The above concentrations represent a snapshot of conditions at the facility. Water is diverted from Clear Creek and Because of differences in timing of sample collection and the time of water travel through the cooling tower system. However, the information can provide evidence of some general conclusions:

- 1) Phosphorus and nitrogen concentrations in the effluent are comparable to the intake water concentrations, indicating minimal concentration of nutrients through evaporation.
- 2) The median effluent concentrations for TP and TIN were below the Regulation 85 effluent limitations for existing domestic wastewater treatment facilities and the median effluent concentrations for TP and TN were below the Regulation 31.17 nutrient interim values for streams.
- 3) This facility does not add chemicals containing nitrogen or phosphorus.
- 4) Therefore, this facility does not add any measurable nutrient load.

Operation type: Daily

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Facility:	Nucla Station (CDPS Permit #CO-0000540)
Source Water:	GUSM04b / Low Priority Watershed – San Miguel
Receiving Water:	GUSM04b / Low Priority Watershed – San Miguel
USGS 8-digit HUC:	14030003
Design flow:	< 1.0 MGD (0.53 MGD permitted monthly average; actual average is about ½ to ¾ of the permit limit)
Owner/Operator:	Tri-State Generation and Transmission Association, Inc.
Facility Description:	<p>Tri-State's Nucla Station is an electric power generating facility (110 MW nominal) operating in southwest Colorado, utilizing water from San Miguel River. When generating power, the facility's two cooling towers are continuously operated. Approximately 90% of intake water is used for cooling purposes. Chemicals are added to cooling tower water to prevent corrosion, scale and bio-fouling. Approximately 75% of the discharge is cooling tower blowdown, which is a slip stream that removes accumulated solids remaining from the evaporation of water. The facility combines cooling tower blowdown and other low volume wastewaters in two lined impoundments prior to discharge for settling and pH control.</p>
Cooling towers:	<p>Cooling towers at this facility operate to maximize evaporation of heat collected during the non-contact cooling process. During the evaporation of water vapor, the remaining solids from intake water and any chemical additives are concentrated and ultimately removed from the cooling tower in the blowdown stream. The concentrating and blowdown rates are dependent on temperature, calcium hardness and other facility-specific factors.</p>
Chemical loading:	<p>Chemical additives are minimized by this facility based on economics and other impacts from usage. This facility applies chemicals on a part per million (ppm) basis year-round in the cooling towers when generating power. Theoretical nutrient load factors from chemicals ranged between 1-4 lbs/day in the monitoring period; however, as shown in the estimated load factors below, the actual impact from chemical additions is generally negligible in the cooling tower blowdown due to evaporative losses or settling.</p> <p>Further, the blowdown loading is more appropriate than chemical loading as it integrates the intake water, cooling tower operations and chemical additions. While actual calculation of added chemical loading is impossible, a qualitative comparison is possible as described below.</p>

Estimated nutrient load factors (based on the average of collected data from 2012-2014):

Average Load Factors	Intake Water*	Cooling Tower Blowdown**	
Total Inorganic Nitrogen	2.0 lbs/day	2.3 lbs/day	690 lbs/yr
Total Nitrogen	4.8 lbs/day	5.7 lbs/day	1710 lbs/yr
Total Phosphorus	0.7 lbs/day	3.0 lbs/day	900 lbs/yr

**Intake water load factors were averaged from all data collected over the monitoring period. The load is multiplied by 0.9 to account for the average percentage of intake water that is used for cooling.*

***Cooling tower blowdown load factors were averaged from each tower over the monitoring period, then added together to represent the total cooling tower blowdown load from this facility. Discharge flows are relatively constant when generating power. Therefore, annual load factors were based on the daily load multiplied by the historical maximum of 10 months of operation.*

The above load factors represent a snapshot of conditions at the facility. Water collected at the facility's intake is transported to a water tank or directly used in the cooling towers. Then cooling tower water is recirculated many times prior to blowdown to maximize efficient water use. Therefore, the mass balance equation of intake + chemical addition = blowdown is too simplistic due to lag times, varying operations and source water conditions (hardness, etc) that may require more or less blowdown, and settling that occurs in the cooling tower basins. However, the information can provide evidence of some general conclusions:

- 1) Load factors showed small increases between intake water and cooling tower blowdown.
- 2) Chemical additions did not significantly increase the load factors in the cooling towers.
- 3) In comparison to domestic wastewater treatment plants, Nucla Station does not contribute a significant nutrient load.

Operation type: Daily (During 2012-2014, the facility generated power 7-10 months per year based on regional electrical power grid needs.)

Operations in 2016: The facility generated power for approximately 6 months. Other low volume wastewaters were discharged when the facility was not generating power.

Other facility info: Tri-State recently announced the facility will close by 12/31/2022.

2017 Cooling Tower Assessment for Regulation 85

Facility:	Rifle Station (CDPS Permit #CO-0042447)
Source Water:	COLCLC01 (City of Rifle) / High Priority Watershed – Lower Colorado River
Receiving Water:	COLCLC04e / High Priority Watershed – unnamed tributary to Dry Creek
USGS 8-digit HUC:	14010005
Design flow:	< 1.0 MGD (0.056 MGD)
Owner/Operator:	Tri-State Generation and Transmission Association, Inc.
Facility Description:	Tri-State's Rifle Station is a peaking electric power generating facility (75 MW nominal) operating in western Colorado and utilizing potable water from the City of Rifle (Lower Colorado River). When generating power (averaging less than 10 days/yr for the last several years), the facility operates one cooling tower continuously. Chemicals are added to cooling tower water to prevent corrosion, scale and bio-fouling. During operations, cooling tower blowdown is a significant wastewater stream.
Chemical loading:	Chemical additives are minimized by this facility based on economics and other impacts from usage. This facility applies chemicals on a part-per-million (ppm) basis in the cooling tower for operations. Given the facility's long-periods of dry layup (when not operating), the theoretical nutrient load factors from chemicals is difficult to calculate. As shown in the estimated load factors below, the actual impact from chemical additions is generally negligible in the cooling tower blowdown.

Estimated nutrient load factors (based on the average of collected data from 2012-2014):

Average Load Factors	Intake Water	Cooling Tower Blowdown	
Total Inorganic Nitrogen	0.005 lbs/day	0.01 lbs/day	0.1 lbs/yr*
Total Nitrogen	0.013 lbs/day	0.07 lbs/day	0.7 lbs/yr*
Total Phosphorus	0.001 lbs/day	0.08 lbs/day	0.8 lbs/yr*

**Annual loads are estimated based on 10 days/year operations.*

The above concentrations represent a snapshot of conditions at the facility. Water is obtained from the City of Rifle (potable water system) on an as-needed basis and recirculated in the cooling tower system to maximize efficient water use. The mass balance equation is not appropriate for this facility that operates so intermittently and due to evaporative losses or settling. However, the information can provide evidence of some general conclusions:

- 1) Load factors showed small increases between intake water and cooling tower blowdown.
- 2) Chemical additions did not significantly increase the load factors in the cooling towers.
- 3) In comparison to domestic wastewater treatment plants, Rifle Station does not contribute a significant nutrient load.

Operation type: Intermittent or batch